DOCUMENT RESUME

ED 138 474 SE 022 496

AUTHOR Ellis, Susanne D.
TITLE Survey of 1975-76 Physics and Astronomy Bachelor's Degree Recipients. AIP Report.
INSTITUTION American Inst. of Physics, New York, N.Y. Education and Manpower Div.
REPORT NO AIP-Pub-R-211.8
PUB DATE Feb 77
NOTE 9p.

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS *Astronomy; Career Planning; *Employment Trends; *Graduate Study; Higher Education; Manpower Utilization; Minority Groups; *Physics; *Student Characteristics; *Surveys

ABSTRACT

This report presents data from a survey of 1975-76 physics and astronomy bachelor degree recipients. From a sample of 3,969 physics graduates, 2,616 responded. From a sample of 180 astronomy graduates, 110 responded. Data on the 1975-76 sample are presented in tabular form, and comparisons are made with responses to previous studies for several items. Highlights from the analyses indicate: (1) a continuing decrease in the number of physics bachelor's degrees granted; (2) a continuing increase in the percentage of physics bachelors who start graduate study in a physics-related area; (3) a continuing increase in the proportion of women among physics degree recipients; and (4) an improved employment market in terms of a larger number of available positions, but a higher proportion of the offers make no use of the graduate's physics training. (Author/RH)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

ED128474

AIP report
MANPOWER STATISTICS DIVISION
American Institute of Physics, 335 East 45 Street, New York, N.Y. 10017 (212) 685-1940

SURVEY OF 1975-76 PHYSICS AND ASTRONOMY BACHELOR'S DEGREE RECIPIENTS

by Susanne D. Ellis

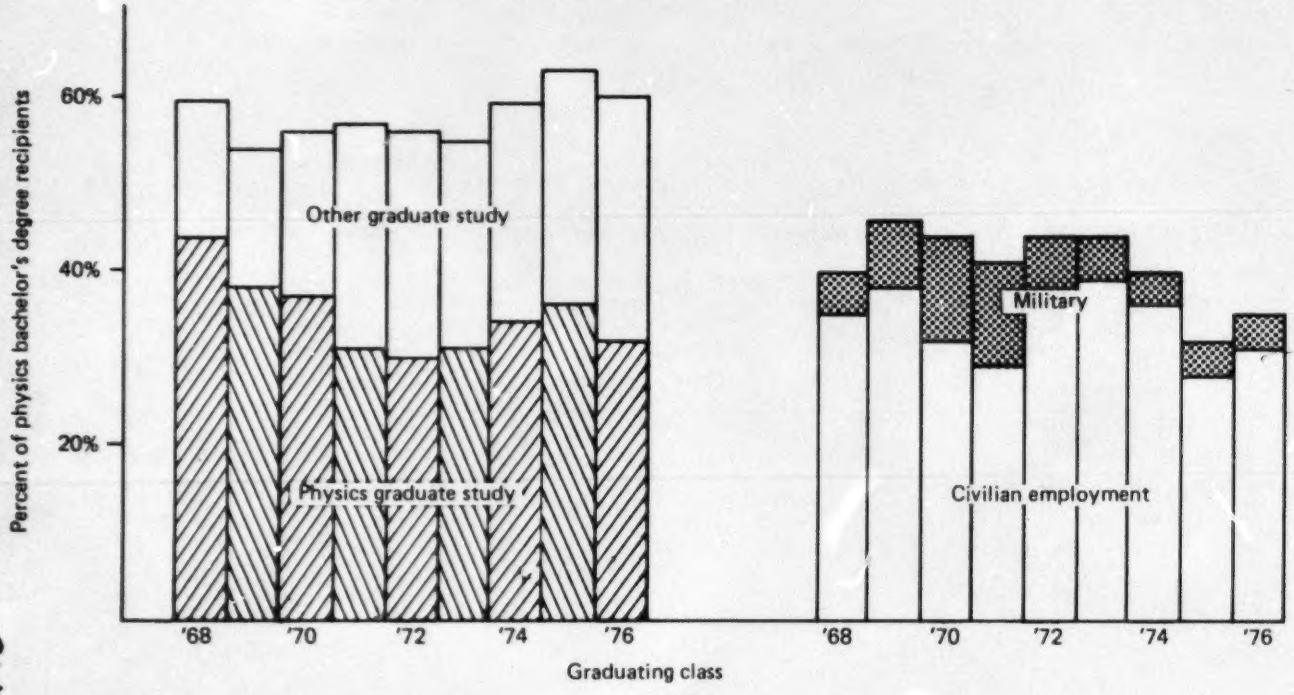
AIP Pub. No. R-211.8 February 1977

The survey of graduates with physics bachelor's degrees was started in the early 1960's; two years ago astronomy bachelors were included in this survey. Highlights from the analysis of these data are:

- a continuing decrease in the number of physics bachelor's degrees granted
- a continuing increase in the percentage of physics bachelors who start graduate study in a physics-related area
- a continuing increase in the proportion of women among the physics degree recipients
- an improved employment market in terms of a larger number of available positions, but a higher proportion of the offers make no use of the graduate's physics training.

Figure I, when examined in conjunction with **Table I**, gives an indication of the future plans of college graduates with physics bachelor's degrees. For the most recent year shown, the largest percentage drop involved bachelors who plan to go on to physics graduate study. Attention should be called to line two of **Table I** "Other graduate study". This category includes primarily fields of study that are closely related to physics, and also shows that an increasing percentage of successive graduating classes considers physics an appropriate preparation for a variety of careers. More graduates than in 1975 appear to be interested in civilian employment causing the percentage of bachelors who start graduate school to decline from 63% to 60%. Being "undecided" upon receiving a physics bachelor's degree is a relatively new phenomenon as the trend data of **Table I** show.

Fig. I. Trend in postbaccalaureate plans of physics bachelors, 1968-76



SE 022 496

MEMBER SOCIETIES
AMERICAN PHYSICAL SOCIETY • OPTICAL SOCIETY OF AMERICA • ACOUSTICAL SOCIETY OF AMERICA • SOCIETY OF RHEOLOGY • AMERICAN ASSOCIATION OF PHYSICS TEACHERS • AMERICAN CRYSTALLOGRAPHIC ASSOCIATION • AMERICAN ASTRONOMICAL SOCIETY • AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE • AMERICAN VACUUM SOCIETY

Table I. Postbaccalaureate plans of successive graduating classes of physics bachelors, 1966–76

Postbaccalaureate plans	Graduating Class 1966–67	1967–68	1968–69	1969–70	1970–71	1971–72	1972–73	1973–74	1974–75	1975–76
Physics graduate study	55%	44%	38%	37%	31%	30%	31%	34%	36%	32%
Other graduate study	19	16	16	19	26	26	24	25	27	28
Civilian employment	22	35	38	32	29	37	39	36	28	31
Military service	4	5	8	12	12	7	5	4	4	4
Undecided	–	–	–	–	2	–	1	1	5	5
Total number of physics bachelor's degrees	5236	5522	5975	5782	5755	5282	4923	4652	4571	4500 est.

Over 5% of the physics bachelors who responded to the survey indicated that they were members of one of six distinct minority groups listed on the questionnaire. An additional 2% of the respondents checked "other" and did not elaborate on that answer. Immediate employment was the postbaccalaureate choice of over 50% of the blacks, Mexican Americans, Other Spanish and American Indians; in the previous year a slightly smaller proportion chose employment. On the other hand close to 80% of the Orientals chose graduate study upon receiving bachelor's degrees irrespective of their citizenship.

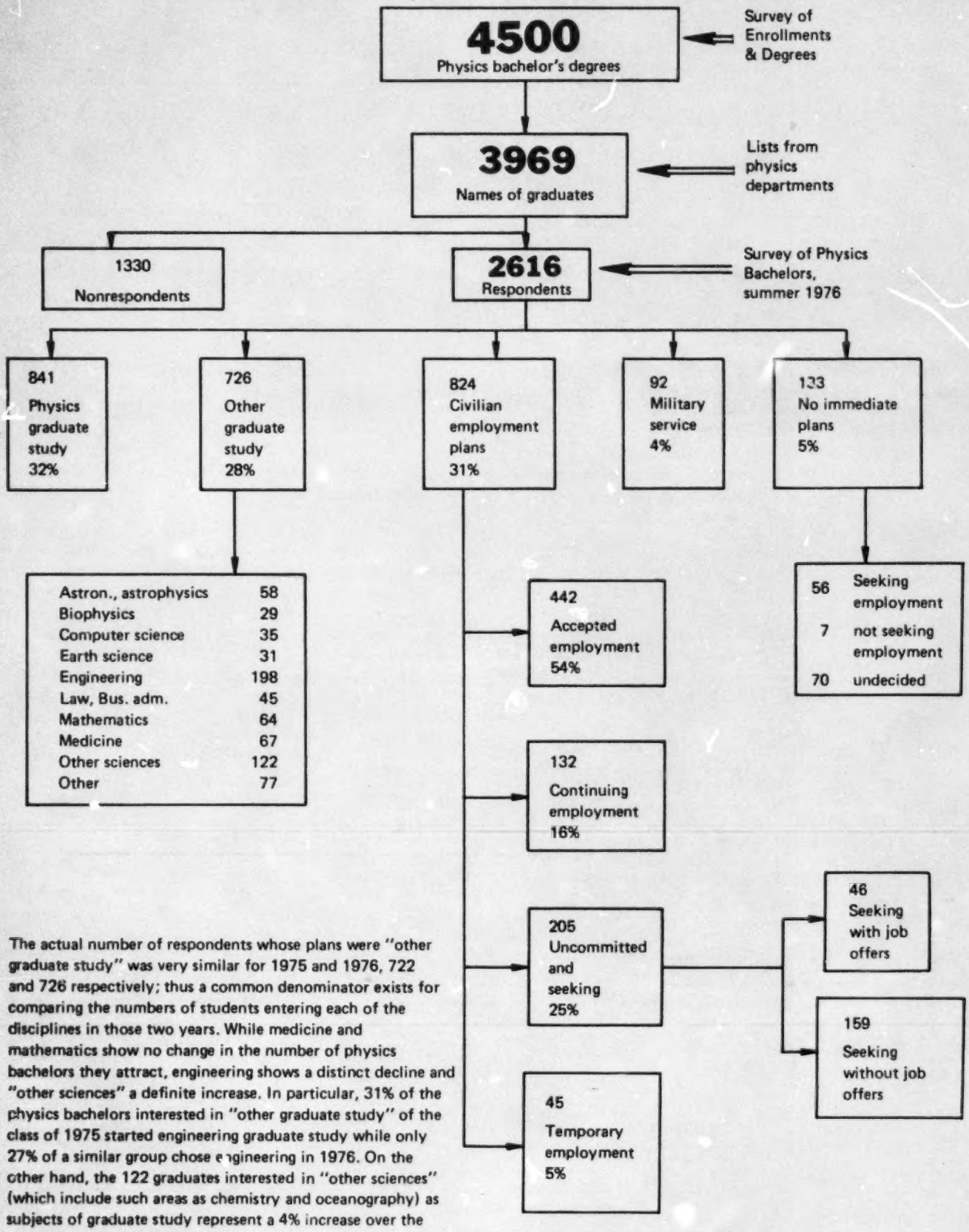
The upper portion of **Figure II** offers some details of how this survey of physics bachelors was conducted. Each of about 800 degree-granting physics departments receives an annual request for a list of names of its graduates whom we then contact individually. Three requests for information from the individual graduates yielded 2616 eligible responses by late autumn of 1976. The respondents include only physics bachelors who received their degrees from July 1975 through June 1976, and most of the information was reported during the summer of 1976. Thus, while some of the respondents report on an activity they are currently pursuing, most of them merely describe plans.

In connection with **Figure I**, it was mentioned that a higher proportion of graduates in 1976 than in 1975 was interested in immediate employment; yet, despite the larger number, that resulted from the higher proportion, the percentage of graduates with employment offers also increased. But before interpreting these statistics to indicate an improved job market, one should examine the types of employment offered to those bachelors. The discussion for **Tables VI** and **VII** will offer some details.

Table II. Postbaccalaureate plans of the members of minority groups among the physics bachelors of the class of 1976

Minority group:	Black	Mexican American	Other Spanish	American Indian	Asian Indian	Oriental U.S.	Oriental Foreign	Other
Graduate study in physics	14	1	2	1	3	19	19	18
Other graduate study	10	1	1	1	2	7	11	21
Engineering	–	1	1	–	–	–	5	5
Medicine or biophysics	2	–	–	–	1	–	2	1
Mathematics	1	–	–	–	–	1	–	2
Other science	5	–	–	1	–	6	4	9
Other	2	–	–	–	1	–	–	4
Employment	25	7	5	4	1	8	5	19
Number of job offers 0	4	3	1	1	–	5	1	3
Number of job offers 1	10	3	4	3	–	–	3	11
Number of job offers 2	4	–	–	–	–	3	1	3
Number of job offers > 3	7	2	–	–	1	–	–	2
Total in survey:	49	10	8	6	6	34	35	58

Fig. II. Postbaccalaureate plans of the class of 1976



The actual number of respondents whose plans were "other graduate study" was very similar for 1975 and 1976, 722 and 726 respectively; thus a common denominator exists for comparing the numbers of students entering each of the disciplines in those two years. While medicine and mathematics show no change in the number of physics bachelors they attract, engineering shows a distinct decline and "other sciences" a definite increase. In particular, 31% of the physics bachelors interested in "other graduate study" of the class of 1975 started engineering graduate study while only 27% of a similar group chose engineering in 1976. On the other hand, the 122 graduates interested in "other sciences" (which include such areas as chemistry and oceanography) as subjects of graduate study represent a 4% increase over the group making that same choice in 1975.

Table III. Characteristics of physics bachelor's degree recipients, 1975–76

Characteristics	Postbaccalaureate plans: Graduate study physics	other	Employment	Undecided	Total
Sex					
Female	10%	11%	13%	13%	11.8%
Male	90	89	87	87	88.2
Citizenship					
U.S.	94%	96%	99%	98%	96.8%
Foreign	6	4	1	2	3.2
Age					
20 or younger	2%	2%	1%	1%	1.7%
21	10	9	4	4	7.4
22	53	58	44	50	51.1
23–29	33	30	43	39	35.9
30 and older	2	1	8	6	3.9
Minority groups					
Black	1.7%	1.4%	1.9%	3.0%	1.8%
Mexican American	0.1	0.1	0.7	0.7	0.3
Other Spanish	0.2	0.1	0.6	–	0.3
American Indian	0.1	–	0.4	–	0.2
Asian Indian	0.4	0.3	0.1	–	0.2
Oriental	4.6	2.6	0.6	3.7	2.6
Other	2.2	2.8	2.0	3.0	2.3
Type of high school physics					
PSSC	36%	35%	35%	37%	35.4%
Project physics	8	9	10	12	9.1
Other	47	47	42	43	45.0
None	9	9	13	8	10.5
Type of undergraduate institution					
PhD-granting	58%	51%	42%	44%	49.8%
MS-granting	15	14	17	12	15.0
BS-granting	27	35	41	44	35.2
Estimated number of bachelors	1440	1260	1575	225	4500
% distribution	32%	28%	35%	5%	100%
Number of respondents	841	726	916	133	2616

The characteristics of the graduating class of 1976 shown in **Table III** are very similar to those of the class of 1975 with two exceptions: a 4% decline in the fraction of graduates who plan to start graduate work in physics, and a continuing increase in the percentage of women graduates among the physics bachelors.

While there are many foreign graduate students who come to the U.S. to study physics, there are always very few foreign students among the undergraduate physics majors.

As in previous years a larger proportion of the bachelors with immediate employment plans is older than those bachelors who start graduate school; 51% of the employment group is 23 years or older, while only 35% and 31% of the prospective graduate students fall into that same age group.

A look at the types of institutions that confer physics bachelor's degrees indicates that graduates from the 4-year colleges are more likely to enter employment directly than the other groups are. On the other hand, those physics majors interested in a graduate physics education chose PhD-granting institutions for their undergraduate training over the smaller institutions by a factor of two to one.

An eight-year trend of employment opportunities is shown in **Table IV.** Starting with 1971 one could view the employment outlook for successive graduating classes as improving steadily,

Table IV. Changes in employment outlook for the new physics bachelor's degree recipients, 1969–1976

Number of job offers at graduation	Summer 1969	Summer 1970	Summer 1971	Summer 1972	Summer 1973	Summer 1974	Summer 1975	Summer 1976
0	20%	24%	49%	41%	26%	18%	20%	19%
1	39	48	39	42	50	50	53	50
2 or more	41	28	12	17	24	32	27	31

Table V. Sources of anticipated support for first-year graduate study*, 1973–1976

Sources of support		Students planning: Physics graduate study				Other graduate study			
		1973	1974	1975	1976	1973	1974	1975	1976
Teaching assistantship		57%	63%	64%	64%	22%	19%	26%	25%
Research assistantship		12	12	12	13	15	20	22	20
Fellowship		12	13	12	13	17	13	13	15
Employment		8	6	4	3	15	17	13	14
Family, savings, loan		4	5	6	6	19	23	18	19
GI Bill		1	1	1	–	3	1	2	–
Other		6	--	1	1	9	7	6	7
Assured		86%	90%	89%	90%	73%	76%	78%	78%
Intended		14	10	11	10	27	24	22	22
Graduate study status	full-time	97%	98%	99%	99%	97%	96%	98%	97%
	part-time	3	2	1	1	3	4	2	3
Total	%	100%	100%	100%	100%	100%	100%	100%	100%
	N	1550	1600	1645	1440	1200	1220	1234	1260

*The information was reported as of September of each academic year.

with the class of 1974 representing an exceptionally favorable year. In this trend improvement is measured not only in terms of a declining percentage of new graduates with zero job offers but also in terms of an increasing percentage of degree recipients with multiple offers to choose from.

The four-year trends presented in **Table V** show a consistent difference between the sources of support offered to first-year graduate physics students and those beginning graduate study in other disciplines. One third of the latter group, currently supports itself by means of student loans, savings or off-campus employment while only 9% of the graduate physics students indicate these sources of support. Also, assistantships are offered to 77% of the prospective physics students compared with offers to 45% of those entering other graduate study. Both groups, however, include only a very small number of bachelors who intend to start graduate study on a part-time basis.

Assuming that physics bachelors seek employment that makes use of their physics training **Table VI**, as an elaboration of **Table I** and **Figure II**, can be interpreted in the following way: While the job market has improved slightly over the previous year in terms of a larger number of available positions, it is a

Table VI. Use of physics training by type of employment, physics bachelors 1976

Newly accepted positions with selected types of employers	Use of physics training: Extensive	Little	None	Number reporting
High school or Junior college	70%	28%	2%	58
Industry-manufacture	38	50	12	140
Industry-service	25	54	21	98
Government, Peace Corps	51	37	12	49
Continuing employment with selected types of employers				
Industry	30%	40%	30%	61
Government	50	12	38	16
All employers	39%	42%	19%	525
Work activities in newly accepted positions				
Science teaching	69%	28%	3%	77
Research & Development	68	30	2	90
Engineering	42	52	6	81
Computer programming	4	80	16	49
Skilled work	20	74	6	34
Nonphysics professional	3	69	28	36

Table VII. Full-time employment* of new physics bachelor's degree recipients, 1976

Work activity		Industry manufacture	Industry service	High school	Coll. or univ.	Government civilian employ.	Government career military	Res. inst.	Other (incl. self-employment)	Total N	Total %
Teaching Physics		1	2	61	5	4	3	1	10	87	14
Other		–	2	6	–	1	–	–	–	9	2
R&D and engineer.		123	38	–	10	29	30	16	7	253	41
Computer program.		15	29	–	6	6	1	2	3	62	10
Mgt. training		5	8	–	–	1	5	–	4	23	4
Nonphysics professional		13	6	–	1	4	20	–	8	52	8
Skilled		11	9	1	4	5	11	–	3	44	7
Unskilled, supervisory & nonsuperv.		10	15	–	–	2	–	1	17	45	7
Other		5	8	1	–	9	12	1	9	45	7
TOTAL	N	183	117	69	26	61	82	21	61	620	
	%	30	19	11	4	10	13	3	10		100%

*The employment of these 620 new graduates includes both newly accepted positions as well as those in which graduates are continuing.

less favorable market when measured in terms of those graduates who accepted positions that make no use of their physics training. Another indication of the quality of the 1976 job market comes from examining newly accepted industrial positions; only 32% of those bachelors who started work in industry, compared with 36% in the previous year, feel they are making extensive use of their training.

Table VII confirms the conclusion drawn earlier in this report that while the quantity of job offers has increased somewhat their quality appears lower. Bachelors engaged in the last three work activities listed in **Table VII** are not employed as professionals, and this group, constituting 21%, represents a 7% increase over the 1975 graduates. The distribution among the traditional as well as professional work activities for the bachelors of the class of 1976 is quite similar to that of earlier graduating classes.

The largest number of employment offers for physics bachelors comes from industry, and this has been true for a number of years as shown in **Table VIII**. Dividing industrial positions into two groups, manufacture and service, provided a category, namely service industry, for all those graduates who accepted work in banks, insurance companies or other profit-making organizations where the bachelor's degree carries more weight than the physics education. Ever since the government discontinued compulsory military service, a substantial number of graduates consider a military career. High school teaching on the other hand holds little appeal when the employment market improves; while a physics bachelor's degree constitutes a good preparation to teach high school physics, the comparatively low salaries offered to teachers channel the graduates into industrial employment.

A frequent request for information is one dealing with salaries paid by specific employers; these requests come not only from new graduates who want to evaluate salary offers they receive but also from employers interested in determining how competitive their offers are on a national scale. **Table IX** lists five types of employers and the median monthly salaries they pay to men or women. While the largest salary differences between men and women were recorded for college or

Table VIII. Initial employment of physics graduates with bachelor's degrees, 1971–1976

Type of employer	Percentage of employed bachelors				
	1971–72	1972–73	1973–74	1974–75	1975–76
Industry manufacture	29%	31%	32%	25%	30%
Industry service	23	23	22	25	19
High school	25	13	10	11	11
College or univ.	5	5	4	5	4
Government civilian employ.	11	6	10	9	10
Government career military	--	13	10	16	13
Res. institutes	5	3	5	4	3
Other	2	6	7	5	10
Total	100%	100%	100%	100%	100%

Table IX. Starting salaries for new physics bachelors, 1976

Type of employer	Men (411 reported salaries)		Women* (81 reported salaries)		Total (492 reported salaries)	
	Distr. by employer	Median salary	Dist. by employer	Median salary	Distr. by employer	Median salary
Industry-manufacture	28%	$1038	39%	$1100	30%	$1047
Industry-service	19	960	17	867	19	938
High school	10	771	17	750	11	765
College or university	4	843	4	700	4	813
Government**	26	900	7	875	23	900
Res. institute	3	1000	6	1000	3	1000
Other	10	750	10	700	10	714
Total	100%	$ 915	100%	$880	100%	$ 905

* Includes accepted and continuing employment
** Career military salaries are included.

university positions they concern only 4% of the graduates. The difference in starting salaries paid by service industries on the other hand, was almost 10% between women and men; again women received the lower salary offers, but in this case approximately one-fifth of the graduating class secured these positions as its initial employment. Grouping all employers together the median salary for women is almost 4% less than that for male graduates; last year's difference was only 1%.

The survey response to the salary question is generally lower than that to other questions; for that reason the percent-distribution by type of employer is based on all employed bachelors and not merely on those who report their salaries.

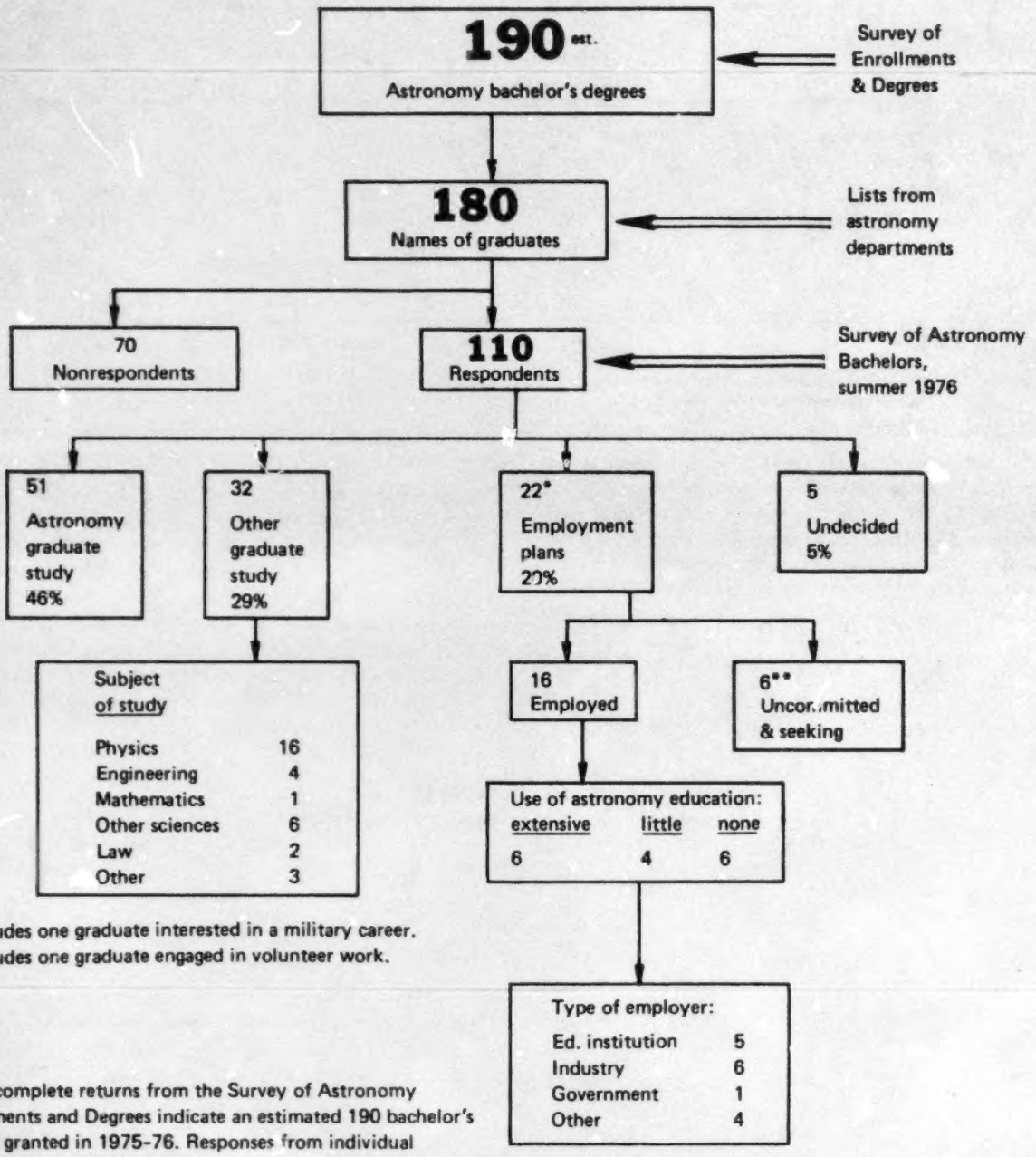
The overall starting salaries of chemistry bachelors are almost identical to those reported by the physics graduates. Women chemists on the other hand reported higher salaries at the bachelor's level than male chemists who started employment. The median monthly salary for women, based on 145 graduates, was $910.—compared with $900.—for male chemists based on 291 graduates. The salary data for chemistry graduates was taken from the "1976 Survey Report, Starting Salaries and Employment Status of Chemistry and Chemical Engineering Graduates" published by the American Chemical Society.

ASTRONOMY

Table X. Characteristics of astronomy graduates with bachelor's degrees, 1975–76

Characteristics		Postbaccalaureate plans: Astronomy graduate study	Other graduate study	Employment plans	Undecided	Total
Sex	Female	8	–	5	–	13
	Male	43	32	17	5	97
Citizenship	U.S.	51	32	22	5	110
	Foreign	–	–	–	–	–
Race	Black	–	–	1	–	1
	Asian Indian	–	1	1	–	2
	Oriental	2	–	–	–	2
	Other	1	3	–	–	4
Age	21 or younger	8	3	1	1	13
	22	39	17	9	–	65
	23–25	3	12	10	4	29
	26 or older	1	–	2	–	3
Type of H.S. physics	PSSC	18	14	8	2	42
	Project physics	–	2	2	–	4
	Other	25	13	8	2	48
	None	6	1	3	–	10
	No response	2	2	1	1	6
Type of bachelor's institution	PhD-granting	36	20	16	4	76
	MS-granting	4	2	–	–	6
	BS-granting	11	10	6	1	28
Number of respondents	N	51	32	22	5	110
	%	46	29	20	5	100%

Fig. III. Postbaccalaureate plans of the class of 1976



* Includes one graduate interested in a military career.
** Includes one graduate engaged in volunteer work.

Still incomplete returns from the Survey of Astronomy Enrollments and Degrees indicate an estimated 190 bachelor's degrees granted in 1975-76. Responses from individual graduates totaled 110 for the second survey of astronomy bachelors. A few of the 110 respondents have received physics bachelor's degrees as well; these graduates come from the combined physics and astronomy departments.

Since there are so few astronomy graduates one should be cautious about reading too much into the data. However, it seems safe to say that a larger fraction of the astronomy bachelors than the physics bachelors goes straight to graduate school. Of the 22 astronomy bachelors interested in employment six had not secured suitable positions by the end of the summer, but three of those six had summer jobs. Furthermore, three graduates reported zero job offers while five graduates reported multiple offers to choose from.

For the class of 1975, eight out of 28 astronomy graduates switched to physics graduate study; for the class of 1976 it is 16 out of 32.

The outstanding characteristics of astronomy bachelors presented in **Table X** include the following: a very high proportion of them graduate from PhD-granting institutions; there are no foreign citizens among the respondents; (last year there were 3 among 96); and the percentage of women graduates is similar to that of the physics bachelors; (last year the astronomers had a higher proportion of women). When only two years of data are available it is too soon to comment on trends.